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THE BRYOPHYTE FLORA OF THE PARK OF MÁTRAJ GYÓGYINTÉZET SANATORIUM (NE HUNGARY)

Péter Szűcs¹, Gergely Baranyi² & Gabriella Fintha²

¹Eszterházy Károly University, Institute of Biology, Department of Botany and Plant Physiology, H-3300 Eger, Leányka str. 6, Hungary; ²Eszterházy Károly University, Faculty of Natural Sciences, H-3300 Eger, Leányka str. 6, Hungary;
*E-mail: szucs.peter@uni-eszterhazy.hu

Abstract: The aim of this study was to explore the bryophyte diversity in the garden of Mátrai Gyógyintézet Sanatorium. In the investigated area 65 bryophytes were found, 3 liverworts and 62 mosses. Some near threatened taxa according to the Hungarian Red List were detected in the territory: *Brachythecium glareosum*, *Cirriphyllum piliferum*, *Orthotrichum pumilum*, *Rhynchostegiella tenella* and *Syntrichia latifolia*. The recent record of *Syntrichia latifolia* is the second in the North Hungarian Mountains, and the first in Mátra Mountains.

Keywords: bryophytes, high altitude, *Syntrichia latifolia*, semi-natural habitats

INTRODUCTION

Parks and large public gardens can be interesting hot spots of biodiversity, since they are places where the human endeavor to form a landscape meets the tendency of nature to conquer back any area where the anthropogenic impact is diminished (Nielsen *et al.* 2014).

During the last decades, the bryophyte floras of several Central and Eastern European parks and gardens have been studied, for example Warsaw, Łódź and other Polish cities (Fudali 2006, Wolski *et al.* 2012), Bucharest (Gomoiu and Ștefănuț 2008), Velký Krtíš (Mišíková *et al.* 2007), Olomouc (Vejmelková 2014), Bratislava (Godovičová and Mišíková 2017), Martonvásár (Nagy *et al.* 2016), and Almásfüzitő (Szűcs *et al.* 2017). The main objective of the present study was the examination of the bryophyte diversity of the garden of Mátrai Gyógyintézet Sanatorium. Such a study seemed particularly promising since the area is situated in a

mountain area, at high elevation, thus exceptional compared with similar studies (e.g. manor park in Martonvásár (Nagy *et al.* 2016)) which refer to lowland areas.

MATERIAL AND METHODS

The nomenclature follows Király (2009) for vascular plants, Söderström *et al.* (2016) for liverworts, Hill *et al.* (2006) for mosses. In order to characterise the conservation and indicator status of taxa the Hungarian Red List was used (Papp *et al.* 2010).

Site details descriptions (in the Appendix) include data in the following order: habitat, GPS-coordinates, date of collection. The identifiers of the quadrates according to the Central European Flora Mapping System were indicated in square brackets (Király *et al.* 2003). Each collection point belongs to the 8185.1 square. Specimens were collected on 22.09.2018 and 03.10.2018, respectively, as indicated in the Appendix.

Collected specimens are stored at the Cryptogamic Herbarium of the Department of Botany and Plant Physiology at the Eszterházy Károly University, Eger (EGR).

Study area

The study area (14 ha), between 650 and 700 meters above the sea level, is situated within Észak Magyarországi Középhegység, (North Hungarian Mountains), in Mátravidék, Magas Mátra, the highest of the Hungarian mountain ranges. It is located in Heves county, within the administrative unit of Mátraháza (Gyöngyös) (Dövényi 2010). We can mainly find volcanic rock, mostly andesite and andesite-liparite tuff. The area involves the highest parts of Mátra Mts with relatively high amount of precipitation, resulting in strong soil leaching. Soils, mostly lava clay, usually have medium water absorption, low water conductivity, and high water retention. Among the soil types, the most common is the brown-forest soil with clay leaching, with various depths and varying bedrock (Baráz *et al.* 2000). The climate of the area is cool and wet. The annual number of sunny hours is 2000 at the highest peaks, and 1900 lower. During summer the number of sunny hours is 740-750, and during winter 250 hours at the highest points. The annual average temperature is 6-8°C. (Dövényi 2010). The southeastern side of the hospital garden is affected by the Bene-stream in a short distance. The flora of the Mátra is rich in mountain elements. The distribution of the vegetation is dependent on the bedrock and the soil type on it. Montane species of vascular plants appear

in the submontane beech forests (*Polystichum aculeatum*, *Lunaria rediviva*, *Daphne mezereum*) (Baráz *et al.* 2000).

The hospital (and probably its own garden) was established between 1927 and 1931 in a former meadow called Nagy Somorrét. In addition to the main building, there were 7 smaller buildings in the area including laundry, garage, residential building, kindergarden and gate. Because of the isolation of the site self-sufficiency was attempted, with own water supply and sewage treatment systems, laundry, bakeries, horticulture, pig farm, maintenance workshops. The staff lived in the premises (Padányi 1933). The current regular garden care works include mowing lawns and gathering leaves. The bryofloristic exploration was carried out by the authors in the fenced-in area of the hospital garden, exploring the following micro-habitats: road bridges, road edges, concrete and stone constructions (*Figure 2*), rooftops, mowed lawns (*Figure 3*), creeks, rock gardens, bark of trees and soil.

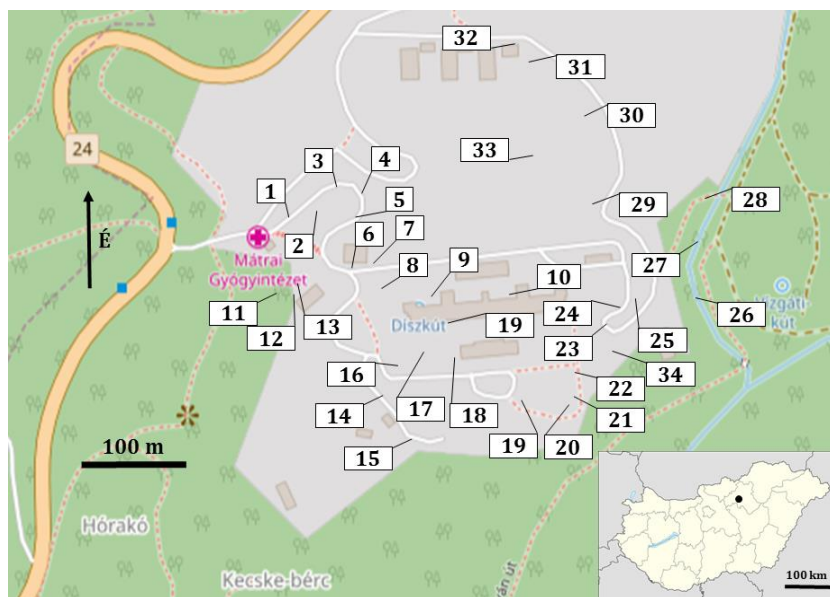


Figure 1. Map of the park of the Mátrai Gyógyintézet Sanatorium and the collecting points (© OpenStreetMap contributors)

RESULTS AND DISCUSSION

List of species

Numbers refer to sites (*Figure 1*) listed in the Appendix. The substrates given after a colon refer to all listed sites.

Marchantiophyta

Frullania dilatata (L.) Dumort. – 11: bark of *Quercus petraea*

Plagiochila porelloides (Torr. ex Nees) Lindenb. – 4, 7: soil

Metzgeria furcata (L.) Corda – 26: bark of *Fagus sylvatica*

Bryophyta

Amblystegium serpens (Hedw.) Schimp. – 17: root of *Carpinus betulus*

Atrichum undulatum (Hedw.) P.Beauv. – 3, 5, 7: soil

Barbula unguiculata Hedw. – 1, 7, 14, 18: soil

Brachytheciastrum velutinum (Hedw.) Ignatov & Huttunen – 4, 28: soil

Brachythecium glareosum (Bruch ex Spruce) Schimp. – 7, 9: soil; 10: artificial stone

Brachythecium rutabulum (Hedw.) Schimp. – 3, 5, 18, 28: soil

Brachythecium rivulare Schimp. – 27: concrete

Bryum argenteum Hedw. – 1, 14, 18: soil; 32: mortar debris

Bryum caespitium Hedw. – 32: mortar debris

Bryum moravicum Podp. – 17: root of *Carpinus betulus*

Calliergonella cuspidata (Hedw.) Loeske – 9: soil

Calliergonella lindbergii (Mitt.) Hedenäs – 7, 24: soil

Campyliadelphus chrysophyllus (Brid.) R.S.Chopra – 7: soil

Ceratodon purpureus (Hedw.) Brid. – 8: asphalt roofing felt; 18: soil

Cirriphyllum piliferum (Hedw.) Grout – 7: soil

Cirriphyllum crassinervium (Taylor) Loeske & M.Fleisch. – 7: soil

Climacium dendroides (Hedw.) F.Weber & D.Mohr – 2, 3, 5: soil

Dicranella heteromalla (Hedw.) Schimp. – 4, 7: soil

Dicranella varia (Hedw.) Schimp. – 14: soil

Drepanocladus aduncus (Hedw.) Warnst. – 19: artificial stone

Dicranum montanum Hedw. – 34: decayed wood

- Dicranum scoparium*** Hedw. – 34: decayed wood
Eurhynchium angustirete (Broth.) T.J.Kop. – 20, 21, 22, 29: soil
Fissidens taxifolius Hedw. – 28: soil
Grimmia muehlenbeckii Schimp. – 23: andesite stone
Grimmia pulvinata (Hedw.) Sm. – 13: artificial stone
Isoetechium alopecuroides (Lam. ex Dubois) Isov. – 11: bark of *Quercus petraea*
Homalia trichomanoides (Hedw.) Brid. – 12: stone
Homalothecium lutescens (Hedw.) H.Rob. – 25: soil
Homomallium incurvatum (Schr. ex Brid.) Loeske – 25: concrete
Hedwigia ciliata (Hedw.) P.Beauv. – 8: asphalt roofing felt; 14, 16, 23: andesite rock
Hygroamblystegium tenax (Hedw.) Jenn. – 26: stone
Hypnum cupressiforme Hedw. – 25: concrete; 30: bark of *Betula pendula*
Orthotrichum affine Schrad. ex Brid. – 30: bark of *Betula pendula*
Orthotrichum anomalum Hedw. – 13, 19: artificial stone; 25: concrete
Orthotrichum cupulatum Hoffm. ex Brid. – 13: artificial stone
Orthotrichum diaphanum Schrad. ex Brid. – 6, 16, 32: artificial stone
Orthotrichum pumilum Sw. ex anon. – 25: bark of *Fraxinus*
Oxyrrhynchium hians (Hedw.) Loeske – 2, 7, 17, 29: soil
Mnium marginatum (Dicks.) P.Beauv. – 7: soil
Plagiomnium affine (Blandow ex Funck) T.J.Kop. – 7, 24: soil
Plagiomnium cuspidatum (Hedw.) T.J.Kop. – 28: soil
Plagiomnium undulatum (Hedw.) T.J.Kop. – 9, 10: soil
Plagiothecium nemorale (Mitt.) A.Jaeger – 26: soil
Platygyrium repens (Brid.) Schimp. – 15: bark of *Quercus petraea*
Pleurozium schreberi (Willd. ex Brid.) Mitt. – 24: soil
Pohlia nutans (Hedw.) Lindb. – 34: decayed wood
Polytrichastrum formosum (Hedw.) G.L.Sm. – 3: soil
Polytrichum juniperinum Hedw. – 3: soil
Pseudoleskeella nervosa (Brid.) Nyholm – 11: bark of *Quercus petraea*
Pseudoscleropodium purum (Hedw.) M.Fleisch. – 20, 21, 33: soil
Pteryginandrum filiforme Hedw. – 26: bark of *Fagus sylvatica*
Pylaisia polyantha (Hedw.) Schimp. – 30: bark of *Betula pendula*
Rhynchostegiella tenella (Dicks.) Limpr. – 22: shaded stone

Rhytidiadelphus triquetrus (Hedw.) Warnst. – 21, 31: soil
Rhytidiadelphus squarrosus (Hedw.) Warnst. – 19, 20, 21, 22: soil
Rhizomnium punctatum (Hedw.) T.J.Kop. – 26, 27: soil
Syntrichia latifolia (Bruch ex Hartm.) Huebener – 13: artificial stone
Syntrichia ruralis (Hedw.) F.Weber & D.Mohr – 8: asphalt roofing felt; 25: concrete
Syntrichia virescens (De Not.) Ochyra – 13: artificial stone
Thuidium assimile (Mitt.) A.Jaeger – 3, 7, 22, 29: soil
Tortula muralis Hedw. – 6, 13, 16, 19, 32: artificial stone, 25: concrete

Number of taxa, conservation status, indicator species

According to the present study, 65 bryophytes were collected in the park of the Mátrai Gyógyintézet Sanatorium, including 3 liverworts and 62 mosses.

The authors found some mosses which are still not threatened, but need attention (LC-att) according to the Hungarian Bryophyte Red List (Papp *et al.* 2010) (e.g. *Brachythecium rivulare*, *Climacium dendroides*, *Grimmia muehlenbeckii*, *Homalia trichomanoides*, *Hypnum lindbergii*, *Mnium marginatum*, *Orthotrichum cupulatum*, *Syntrichia virescens*).

Near threatened species were as follows from the study area: *Brachythecium glareosum*, *Cirriphyllum piliferum*, *Orthotrichum pumilum*, *Rhynchostegiella tenella* and *Syntrichia latifolia*.

Some indicator species, which show a greater level of conservation value of the habitat, also occur in the park, e.g. *Grimmia muehlenbeckii*, *Homalia trichomanoides*, *Mnium marginatum*, *Orthotrichum cupulatum*, *Orthotrichum pumilum* and *Rhynchostegiella tenella*.

Syntrichia latifolia

Syntrichia latifolia is a temperate floral element with circumpolar distribution, which mainly occurs on roots and boles of *Salix* and *Populus* trees in Central Europe, but has also been collected from anthropogenic substrate, for example concrete, bitumen and asphalt (Dierßen 2001, Düll 2010).

In Hungary, this moss has been found until recently only on the bark of trees or less often thatched roofs along the riparian zone of the rivers of Danube and Tisza in Hungary (Orbán and Vajda 1983).

P. Erzberger detected the first record of this species growing on andesite rock in a colline area of Hungary (Cserhát Mts., Zsunyi-brook) (Erzberger 2002). New interesting data from bark of *Fagus sylvatica* were published from Zala county (W Hungary), 300 m above sea level (Papp and Szurdoki 2018).

Our find is the first data from a mountain region, and the first published record from a man-made substrate (artificial stone) in Hungary (*Figure 2*). However, earlier in 2018 the species was found on concrete in the region of Zselic by K. Baráth and P. Erzberger in the village of Bárdudvarnok-Bánya in Somogy County (unpublished, P. Erzberger pers. comm.) On the other hand, our record represents the second locality to the North Hungarian Mountains, and the first to the Mátra Mts.

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APPENDIX

Site details

1. roadside (22.09.2018, 03.10.2018,) N47°51'53" E19°58'26"
2. mown lawn (22.09.2018) N47°51'53" E19°58'29"
3. embankment of road (22.09.2018, 03.10.2018) N47°51'54" E19°58'30"
4. roadside (03.10.2018) N47°51'54" E19°58'30"
5. embankment of road (22.09.2018, 03.10.2018) N47°51'53" E19°58'29"
6. artificial stone wall (03.10.2018) N47°51'52" E19°58'30"
7. submontane beech forest (03.10.2018) N47°51'52" E19°58'31"
8. asphalt roofing felt (03.10.2018) N47°51'51" E19°58'32"
9. mown lawn (03.10.2018) N47°51'51" E19°58'32"
10. mown lawn and pavement (03.10.2018) N47°51'51" E19°58'37"
11. woody vegetation (03.10.2018) N47°51'50" E19°58'26"
12. stony embankment of road (03.10.2018) N47°51'51" E19°58'27"
13. stairs handrail (03.10.2018) N47°51'51" E19°58'28"
14. roadside, public flowerpot and andesite rock (22.09.2018) N47°51'47" E19°58'29"
15. roadside (22.09.2018) N47°51'47" E19°58'31"
16. rockery (22.09.2018, 03.10.2018) N47°51'48" E19°58'32"
17. mown lawn (22.09.2018, 03.10.2018) N47°51'49" E19°58'34"
18. roadside (03.10.2018) N47°51'49" E19°58'35"
19. abandoned fountain pool (22.09.2018) N47°51'48" E19°58'38"
20. embankment and mown lawn (22.09.2018) N47°51'48" E19°58'39"
21. embankment and mown lawn (22.09.2018) N47°51'48" E19°58'39"
22. stony ditch (22.09.2018) N47°51'49" E19°58'39"
23. stony embankment of road (03.10.2018) N47°51'48" E19°58'44"
24. embankment of road (03.10.2018) N47°51'50" E19°58'45"
25. mown lawn and roadside (03.10.2018) N47°51'50" E19°58'44"
26. brook (03.10.2018) N47°51'50" E19°58'52"
27. brook (03.10.2018) N47°51'52" E19°58'52"
28. roadside, construction waste (03.10.2018) N47°51'52" E19°58'52"
29. dirt road, mown lawn (03.10.2018) N47°51'54" E19°58'42"
30. roadside, trees (03.10.2018) N47°51'57" E19°58'41"
31. mown lawn (03.10.2018) N47°51'57" E19°58'41"
32. building, artificial stone (03.10.2018) N47°51'59" E19°58'38"
33. mown lawn (03.10.2018) N47°51'56" E19°58'39"
34. *Picea* plantation, stump (03.10.2018) N47°51'56" E19°58'39"

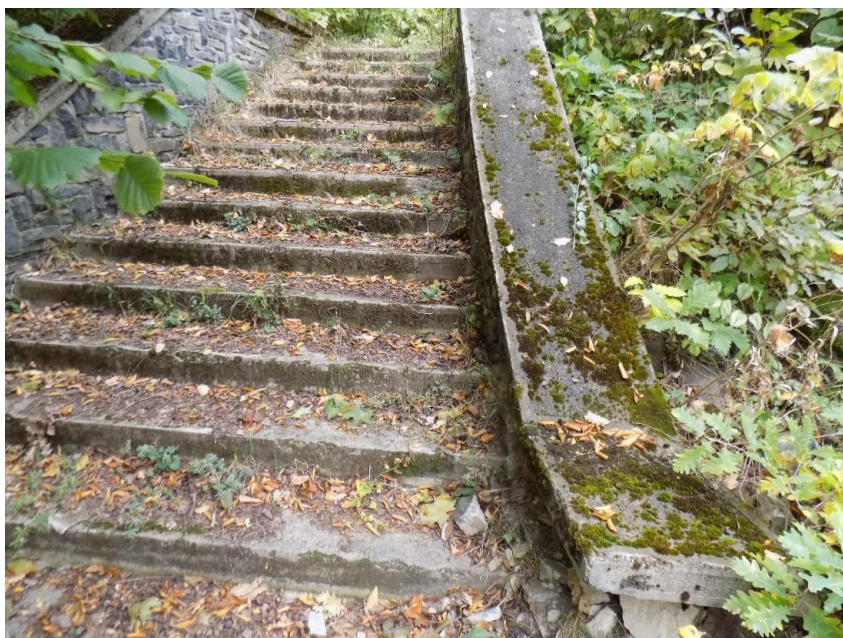


Figure 2. The occurrence of *Syntrichia latifolia* on the stairs handrail (photo: P. Szűcs)



Figure 3. The mown lawn habitat of park of Hospitals Mátra (photo: P. Szűcs)